

Heat switches providing low-activation power and quick-switching time for use in Adiabatic Demagnetization Refrigerators

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An adiabatic demagnetization refrigerator (ADR) is a solid-state cooler capable of achieving sub-Kelvin temperatures. It neither requires moving parts nor a density gradient in a working fluid making it ideal for use in space-based instruments. The flow of energy through the cooler is controlled by heat switches that allow heat transfer when on and isolate portions of the cooler when off. One type of switch uses helium gas as the switching medium. In the off state the gas is adsorbed in a getter thus breaking the thermal path through the switch. To activate the switch, the getter is heated to release helium into the switch body allowing it to complete the thermal path. A getter that has a small heat capacity and low thermal conductance to the body of the switch requires low-activation power. The cooler benefits from this in two ways: shorter recycle times and higher efficiency. We describe such a design here.

RECEIVED MAR 28 1984